CHARTA LEARNING · LESSON NOTES

The economy and the markets

Portfolio Management

1 A story: the price tag recipe

- Price = present value of expected cash flows
- Discount rate = default-free + risk premium
- So news has only three channels to a price
- Ask: which ingredient did the news touch?

IN THE LESSON

- Imagine a bakery that will hand you a loaf every week for as long as you live.
- What would you pay for that?
- You would add up the loaves you expect, shrink the faraway ones because waiting is costly, and shrink them a bit more because the baker might close.
- A price is built this way.
- It is the present value of expected cash flows, discounted at a rate with two parts: the default free rate for each time horizon, and a risk premium for bearing risk.
- This recipe has three ingredients, so news about the economy can change a price in only three ways.
- Find which ingredient the news touches, and you can explain the move.
- Our guide today is Ines Varga, a strategist at a made up firm, Calder Lane Capital.

2 Three channels, one price

Discount rate side

Default-free yields → Risk premium → Required return

Cash flow side

Size of cash flows → Timing of cash flows → Expected dividends

IN THE LESSON

- Follow the boxes.
- The top row is the discount rate side.
- News can move the default free yield curve, which is what the government pays to borrow at each maturity, say one year or ten years.
- Or it can move the risk premium, the extra return investors demand for taking risk.
- Those two add up to the required return.
- The second row is the cash flow side.
- News can change how large the expected cash flows are, or how soon they arrive.
- A sooner dollar is worth more than a later one.
- Every economic factor, whether it is unemployment, inflation or a trade deal, must act through at least one of these three boxes.
- If it touches none, it cannot move a fair price.

3 The valuation arithmetic

Price = D ÷ (Rf + premium − g)

Dividend	Next year's expected dividend
Default-free rate	Default-free rate: channel one
Risk premium	Risk premium: channel three
Growth	Dividend growth: channel two

IN THE LESSON

- To see the channels at work we need a small model.
- Take a share whose dividend is expected to grow at a steady rate for ever.
- Its value is next year's expected dividend, divided by the required return minus that growth rate.
- The required return is the default free rate plus the equity risk premium.
- Now the three channels are visible.
- A bigger or sooner dividend raises the top.
- A higher default free rate raises the bottom and lowers the value.
- A bigger risk premium also raises the bottom and lowers the value.
- Notice something else: the bottom is a small difference between two numbers, so a modest move in the discount rate causes a large move in price.

4 Example 1: good news, lower price

Start: D 5, g 3%, Rf 3%, premium 5%

Before	5 ÷ (0.08 − 0.03)	**100.0**
Cash flows up: D 5.2	5.2 ÷ 0.05	**104.0**
Rate up: Rf 3.6%	5.2 ÷ (0.086 − 0.03)	**92.9**
Premium down: 4.8%	5.2 ÷ (0.084 − 0.03)	**96.3**
Net change	96.3 − 100	**−3.7**

IN THE LESSON

- Example one.
- Varga values an index share.
- Next year's dividend is five, growth is three per cent, the default free rate is three per cent and the equity risk premium is five per cent.
- The value is five divided by zero point zero five, which is one hundred.
- Now a strong growth report arrives.
- She raises the expected dividend to five point two: the value goes to one hundred four.
- But the same report lifts the default free rate to three point six per cent, and the value drops to ninety two point nine.
- Finally investors feel braver and the premium eases to four point eight per cent, which gives ninety six point three.
- The net change is minus three point seven.
- Strong data, and a lower price.

5 Reading the example

- Channels can pull in opposite directions
- The net move depends on which one is largest
- Long-dated assets are the most rate sensitive
- Strong data can lower prices if rates rise

IN THE LESSON

- What did the example teach?
- First, the channels pull in different directions, and the total depends on which is biggest.
- Here the rate channel, minus eleven point one, beat the cash flow channel, plus four, and the premium channel, plus three point four.
- Second, the order in which you apply the channels changes the size of each step a little, but never the total.
- Third, a share is a long dated asset, so most of its value sits in distant cash flows, and a small change in the discount rate bites hard.
- Fourth, the same news can move all three channels at once: a surprise rise in unemployment can cut profits, lower expected policy rates and raise risk aversion together.
- Never label a headline good or bad without checking all three.

6 A story: the surprise party

- Prices already hold the market's forecasts
- Only the unexpected part of news moves them
- Surprise = announced − priced in
- Revised forecasts, not the headline, move value

IN THE LESSON

- Suppose your friends throw you a birthday party and you know about it a month ahead.
- When the day comes, you feel pleased but not astonished.
- The excitement happened weeks ago, when you first heard.
- A surprise party is different: the whole reaction lands on the day.
- Markets work like the first kind.
- Prices already hold the market's forecasts of growth, inflation, policy rates and profits.
- When the news arrives, only the unexpected part, the surprise, changes the price.
- Anything fully expected was priced in long ago.
- And the surprise matters through what it does to forecasts: a revision to what people expect about the future is what actually moves value.

7 The surprise

Surprise = announced − priced in

Announced	What the bank or firm reports
Priced in	Expectation in prices or consensus
Surprise	The part that moves the price

IN THE LESSON

- Here is the idea as a short formula.
- To judge a price move, do not ask whether the announcement was good.
- Ask how far it landed from what was already priced in.
- The surprise equals what was announced minus what was expected.
- Where do we read the expectation?
- From market prices themselves, such as interest rate futures and forward rates, or from the average forecast of analysts, called the consensus.
- If the surprise is zero, the price should barely move, however dramatic the announcement sounds.
- If the surprise is positive for the price, it rises, and if negative, it falls.
- The size of the move then depends on how much the surprise changes forecasts further out.

8 Example 2: rates up, bond up

Policy rate 4.25%, futures 95.25, note duration 1.9

Rate priced in	100 − 95.25	**4.75%**
Expected rise	4.75 − 4.25	**0.50**
Surprise	0.25 − 0.50	**−0.25**
Note price change	−1.9 × (−0.25)	**+0.48%**
Had the rise been 0.50	surprise is zero	**no move**

IN THE LESSON

- Example two.
- The policy rate stands at four point two five per cent.
- A futures contract on that rate trades at ninety five point two five.
- Futures are quoted as one hundred minus the rate, so the market is pricing a rate of four point seven five.
- The expected rise is half a point.
- The central bank then raises the rate by only a quarter point.
- Rates did go up, but the surprise is minus a quarter point, an easing relative to the price.
- A two year note with modified duration one point nine gains about one point nine times a quarter point, which is plus zero point four eight per cent.
- Had the bank raised half a point, the surprise would be zero and the price about unchanged.

9 The price moves with the surprise

Chart: Note price change vs Rise announced (points)

- 0.25 announced: +0.48%
- 0.50 is priced in: no move

IN THE LESSON

- Let us draw it.
- The horizontal axis is the rise the central bank announces, from zero to one point.
- The vertical axis is the change in the note's price.
- Follow the sloping line from the left.
- If the bank announces no rise at all, the note gains nearly one per cent.
- As the announced rise grows, the gain shrinks.
- The flat grey line is no change.
- Where the two lines cross, at a half point, the price does not move.
- That is the rise already priced in.
- The marked point shows our example: a quarter point announced gives a gain of about half a per cent.
- Right of the crossing the rise was larger than expected, and the note loses.

10 Example 3: record profits, lower price

Tollan Retail: last year 1.80, consensus 2.10

Last year	earnings per share	**1.80**
Consensus this year	analysts' average	**2.10**
Reported	a record	**2.00**
Growth on last year	2.00 ÷ 1.80 − 1	**+11.1%**
Surprise	(2.00 − 2.10) ÷ 2.10	**−4.8%**

IN THE LESSON

- Example three, the same logic for a company.
- Tollan Retail, a made up supermarket group, earned one eighty a share last year.
- Analysts on average expected two ten this year, which is the consensus.
- Tollan reports two oh oh, a record.
- Earnings grew by eleven point one per cent, which sounds splendid.
- But compared with the consensus the surprise is minus ten cents, or about minus four point eight per cent.
- Investors also trim their forecasts for later years, since a miss often hints at weaker trading.
- If forecasts fall by the same share, the fair value falls by about the same share, roughly five per cent.
- The record changed nothing: the gap to expectations moved the price.

11 Mistakes so far

- Good-looking data can lower prices (rates rise)
- Check all three channels, not one
- Compare news with what was priced in
- Expectations live in futures, forwards, consensus

IN THE LESSON

- Time to collect the traps from the first two ideas.
- The first mistake is to call a headline good or bad for prices on its own.
- Strong growth data lowered the price in example one, because rates mattered more than dividends.
- The second mistake is to stop at one channel.
- Always ask about the default free rate, the cash flows and the risk premium before you decide.
- The third mistake is to judge a price move by the direction of the announcement.
- A rate rise smaller than priced in lifts bond prices, and record profits below the consensus pull a share down.
- The fourth mistake is to forget where the expectation lives: in futures prices, forward rates and the consensus.
- Compare the news with those, not with last year.

12 A story: the borrowing neighbour

- High trend growth: households expect to be richer
- They want to spend now, not save
- A higher real rate is needed to make them save
- So average real rates rise with trend growth

IN THE LESSON

- Picture two neighbours.
- The first expects to earn the same next year as this year.
- The second knows a big raise is coming and a richer future is almost certain.
- Who wants to save today?
- The second neighbour would rather borrow and enjoy life now, since tomorrow looks so comfortable.
- To keep that neighbour saving, a bank must pay a higher reward for waiting.
- Now scale the story up to a whole economy.
- When trend growth, the steady long run pace of output, is high, households expect to be richer, they want to consume more now, and a higher real interest rate is needed to persuade them to save instead.
- So the average real short term rate rises with expected growth.

13 Example 4: two economies

Patience 0.98; consumption 100 today

Bond price, A (101 next year)	0.98 × 100 ÷ 101	**0.9703**
Real rate, A	1 ÷ 0.9703 − 1	**3.06%**
Bond price, B (103 next year)	0.98 × 100 ÷ 103	**0.9515**
Real rate, B	1 ÷ 0.9515 − 1	**5.10%**
Gap in real rates	5.10 − 3.06	**2.04 pts**

IN THE LESSON

- Example four.
- Two made up economies share the same patience, a factor of zero point nine eight, and the same taste for smoothing consumption.
- Today's consumption is one hundred in both.
- In economy A it is expected to be one hundred one next year, one per cent growth.
- In economy B it is one hundred three, three per cent growth.
- A one year real bond pays one unit.
- Its price is patience, times today's consumption, over next year's.
- For A that is zero point nine seven oh three, a real rate of three point oh six per cent.
- For B the price is zero point nine five one five and the real rate five point one oh per cent.
- Two points more growth, about two points more on the real rate.

14 Real rate against trend growth

Chart: Average real short rate vs Trend growth (% a year)

- A: growth 1%, rate 3.06%
- B: growth 3%, rate 5.10%

IN THE LESSON

- Here is that link as a picture.
- The horizontal axis is trend growth, from zero to four per cent a year.
- The vertical axis is the average real short term rate.
- The line climbs from left to right: more growth, higher rate.
- Now look at the two marked points.
- Economy A, with growth of one per cent, sits low on the line at three point oh six per cent.
- Economy B, with growth of three per cent, sits much higher, at five point one oh.
- The line stands for the level the real rate moves around over a full cycle.
- A central bank can hold rates under the line for a while, but it cannot keep them there for ever, because the line comes from the economy.

15 Growth volatility: two views

Effect on the average real short rate

Driver	Effect
Higher trend growth	Higher real rate
More volatile growth: curriculum	Higher real rate
More volatile growth: precaution	Lower real rate
Who sets the average?	The economy

IN THE LESSON

- What about the bumpiness of growth?
- Here the models disagree, and you should know both.
- Volatility of growth means how much actual growth swings around its trend, measured by the standard deviation of growth.
- In the curriculum's framework, investors who face more uncertain future consumption demand a higher real return for giving up spending today, so real rates rise with volatility.
- In standard consumption models the effect runs the other way.
- With more uncertainty, people save more as a precaution, called precautionary saving, and that extra saving pushes real rates down.
- On growth itself the models agree: higher trend growth means higher real rates.
- On volatility, state the view the question asks for, and name the opposing view as the exam may test it.

16 Cycles around different levels

Chart: Real short rate vs Time

- Faster growth
- Slower growth

IN THE LESSON

- Now the trap, in a picture.
- Time runs along the bottom, and the vertical axis is the real short term rate.
- The two wavy lines are two economies.
- Each wave shows the central bank at work: it raises rates in booms and cuts them in slowdowns, so the rate rises above its usual level and falls below it.
- But look at where each wave is centred.
- The upper line belongs to the faster growing economy and the lower line to the slower one.
- The gap between their centres is set by growth, and nothing the central banks do over a cycle will close it.
- Policy moves the rate around its average.
- It does not choose the average.
- That is why a long run forecast of real rates starts from trend growth.

17 A story: the thermostat

- The central bank is the thermostat
- Weak economy: cut rates. Overheating: raise them
- Short yields follow the policy rate closely
- Long yields follow expected averages, so move less

IN THE LESSON

- Think of a central bank as a thermostat for the economy.
- When the room is too cold, the economy is weak, so it turns up the heat by cutting rates.
- When the room is too hot, with prices rising fast, it turns the heat down by raising rates.
- The business cycle is the repeating swing between expansion and contraction.
- Over the cycle, then, the policy rate moves a lot at the short end.
- Long term yields behave differently, because they reflect where people expect policy and inflation to average over many years.
- The yield curve, a line of yields at different maturities, is simply the picture of short rates against long ones, and its shape tells the story of the cycle.

18 The cycle, drawn

Chart: Output (GDP) vs Time

- Expansion
- Peak
- Contraction
- Trough
- Trend

IN THE LESSON

- Here is the cycle, and we will hang the rate story on it.
- Follow the green line.
- It climbs in an expansion, and as it rises, firms hire and sell more.
- Near the top, the peak, spare capacity is used up and inflation tends to build, so the central bank tightens.
- The line then falls in a contraction, and the bank eases.
- At the bottom, the trough, the economy has spare capacity, inflation is low and rates are at their lowest.
- The grey line is the trend.
- Keep this picture in mind.
- In the next two slides we place the policy rate, the shape of the yield curve and the winning bonds around the cycle.

19 Stage by stage

Stage, policy, curve and the better bonds

Stage	Policy, curve, bonds
Recession	Cuts; steep; long bonds best
Early expansion	Rates low; curve steep
Late expansion	Hikes; flat; long bonds worst
Before downturn	Curve may invert

IN THE LESSON

- Now the stages in order.
- In a slowdown or recession the central bank cuts.
- Short yields fall furthest, since they track the policy rate, so the curve steepens: investors expect today's low rates to be raised later.
- Long government bonds, with their long duration, do best as yields fall.
- In early expansion the bank holds rates low and the curve stays steep.
- As the expansion matures and inflation builds, the bank tightens.
- Short yields rise faster than long ones, the curve flattens, and it often inverts, short yields above long, before a downturn, because investors expect the coming cuts.
- Long bonds do worst during tightening.
- The table puts it in a line each.

20 Steep in recession, inverted late

Chart: Yield vs Maturity

- Recession: steep
- Late expansion: inverted

IN THE LESSON

- Let us draw two yield curves.
- The horizontal axis is the maturity of the bond, from short to long.
- The vertical axis is the yield.
- The lower line is a recession curve.
- It starts low at the short end, because the central bank has cut, and rises steeply.
- The upper line is a late expansion curve.
- It starts high at the short end, because the bank has tightened, and slopes down to the right.
- That downward slope is an inversion.
- Notice that the short end swings by far more than the long end.
- The long end is anchored by what investors expect for policy and inflation over a decade, so it moves less.
- An inverted curve is read as a warning that cuts lie ahead.

21 The Taylor rule

$i = r^* + \pi + 0.5(\pi - \pi^*) + 0.5 \times \text{gap}$

Neutral real rate	Neutral real rate
Inflation	Current inflation: do not forget
Inflation gap	Half of inflation less target
Output gap	Half of the output gap
Policy rate	Nominal policy rate

IN THE LESSON

- A common guide to where policy should be is the Taylor rule.
- It starts from a neutral nominal rate, which is the neutral real rate plus current inflation.
- Then it adds two corrections.
- If inflation is above the target, raise the rate by half the gap.
- If output is above potential, a positive output gap, raise the rate by half the gap.
- If either is negative, the rate falls.
- The answer is a nominal policy rate.
- The classic slip is to leave out current inflation.
- Then you have computed something close to a real rate, which looks far too low when set against a nominal policy rate.
- The rule is a guide, not a promise, but it shows why hikes come late in an expansion and cuts in a recession.

22 Example 5: the rule over the turn

Neutral real rate 1%, inflation target 2%

Late expansion: rule	1 + 4 + 0.5×2 + 0.5×1	**6.5%**
Policy rate now	6.5 − 5.0 too low by	**1.5 pts**
Forgetting inflation	1 + 0.5×2 + 0.5×1	**2.5%**
Recession: rule	1 + 2 + 0 + 0.5×(−3)	**1.5%**
Swing across the turn	1.5 − 6.5	**−5.0 pts**

IN THE LESSON

- Example five.
- The neutral real rate is one per cent and the inflation target two per cent.
- Late in an expansion inflation is four per cent, the output gap is plus one, and the policy rate is five per cent.
- The rule gives one plus four, plus half of two, plus half of one: six point five per cent.
- So five per cent is too low, and a rise of one and a half points is called for.
- Leave out the inflation term and you get two point five, which wrongly suggests a cut.
- A year later, in recession, inflation has fallen to two per cent and the gap is minus three.
- The rule gives one plus two, plus nothing, minus one and a half: one point five per cent.
- A swing of five points.

23 Example 6: which bonds win

Recession: 2-year yield falls 2.0, 10-year falls 1.0

Short end moved	2-year fall	**2.0 pts**
Long end moved	10-year fall	**1.0 pt**
Curve steepens by	2.0 − 1.0	**1.0 pt**
2-year note gain	1.9 × 2.0	**+3.8%**
10-year bond gain	8.0 × 1.0	**+8.0%**

IN THE LESSON

- Example six.
- Now the bonds.
- In the recession the two year yield falls two points and the ten year yield falls one point.
- The short end moved twice as far, so the gap between long and short yields widens by one point: the curve steepens.
- But which bond made more money?
- A bond's price gain is roughly its duration times its yield fall.
- The two year note, with duration one point nine, gains one point nine times two, which is three point eight per cent.
- The ten year bond, with duration eight, gains eight times one, which is eight per cent.
- The long bond gains more than twice as much, because its duration is more than four times as long.
- A steeper curve does not mean the short bond wins.

24 Price gains when yields fall

Price gain (%)

Two-year note	**+3.8%**
Ten-year bond	**+8.0%**

Gain is roughly duration times yield fall

IN THE LESSON

- A last picture for the same example.
- Two bars.
- The vertical axis is the price gain in per cent.
- The first bar is the two year note: its yield fell the most, two points, yet its gain is only three point eight per cent.
- The second bar is the ten year bond: its yield fell just one point, yet its gain is eight per cent, more than double.
- This is the lesson to take to the exam.
- The curve steepening tells you about yields.
- The price effect also needs duration.
- Long maturity government bonds do best when rates fall into a downturn, and they do worst when the central bank tightens, because the same duration works against you when yields rise.

25 Recap and the last traps

- Three channels: rates, cash flows, risk premium
- Price reacts to the surprise, not the headline
- Real rate average comes from growth, not the bank
- Cuts steepen the curve; hikes flatten it
- Taylor rule: include current inflation

IN THE LESSON

- Let us gather everything.
- News reaches a price through three channels: default free rates at each maturity, the size and timing of cash flows, and risk premiums.
- Only the unexpected part of news moves prices, so compare an announcement with what was priced in.
- The average real short rate is tied to trend growth, higher growth meaning higher real rates, and the curriculum links more volatile growth to a higher required return, while precautionary saving points the other way.
- Central banks move rates around that average, they do not set it.
- Through the cycle, cuts steepen the curve, hikes flatten it, and long bonds gain most when rates fall.
- Finally, in the Taylor rule, never forget current inflation.

26 Try three quick questions

1. Rf rises 0.5 pts; D 6, premium 4%, g 3%, Rf 4%. Price?
   Answer: 120 → 109.1; down about 9.1%.
2. Futures 96.00, rate 3.50, bank raises 0.75. Surprise?
   Answer: Priced 4.00; expected +0.50; surprise +0.25; bond falls.
3. r* 1, inflation 3, target 2, gap −2. Taylor rate?
   Answer: 1 + 3 + 0.5 − 1 = 3.5%.

IN THE LESSON

- Now try three questions yourself, and pause after each.
- Question one.
- A share has a next year dividend of six, a risk free rate of four per cent, a risk premium of four per cent and growth of three per cent.
- Data lift the risk free rate by half a point and nothing else changes.
- What happens to the price?
- It was six over five per cent, one hundred twenty, and becomes six over five and a half, about one hundred nine, a fall of about nine per cent.
- Question two.
- A futures price of ninety six means four per cent is priced in.
- The rate is three and a half.
- The bank raises seventy five basis points.
- Surprise?
- Expected half a point, so plus a quarter, and the bond falls.
- Question three.
- Neutral rate one, inflation three, target two, gap minus two.
- Taylor rate?
- One plus three plus a half, minus one: three and a half per cent.
- Well done, and good luck with the practice.